

placed on deck and in small boats around the vessel to detect and destroy any escaping rats.

The water supply must be changed without delay, the casks or tanks disinfected by steam or 10 per cent solution of potassium permanganate, and, after thorough rinsing, refilled from a source of undoubted purity, or the water supply must have been recently boiled. Some water tanks are not readily inspected and cleansed on account of their inaccessibility; these may be rendered safe by leading a steam pipe into them and boiling the water in situ.

Nothing shall be thrown overboard from the vessel, not even deck sweepings. Such material shall be burned in the furnace or in a place specially designated, but not in the galley.

The body of no person dead of plague shall be allowed to pass through quarantine. The body should be cremated, if practicable. If not, it should be wrapped, without preliminary washing, in a sheet saturated with a solution of bichloride of mercury, 1 to 500, surrounded in the coffin by twice the body weight of caustic lime and buried.

Disinfection of Holds of Vessels.—By twenty-four hours' exposure to sulphur dioxide, 10 per cent per volume strength, generated by an approved furnace, or forty-eight hours' exposure to 5 per cent per volume strength, generated by pots.

No person should be allowed on the vessel or around the cargo with bare feet, and the use of proper caution in handling dead vermin is advised.

Living Compartments of all Classes of Vessels.—The preliminary disinfection shall be done with sulphur dioxide and not with formaldehyde on account of the greater potency of the former against animal life.

Note.—Navigation Laws of the United States, section 5, act August 2, 1883:

"Every steamship or other vessel carrying or bringing emigrant passengers, or passengers other than cabin passengers, exceeding fifty in number, shall carry a duly qualified and competent surgeon or medical practitioner; who shall be rated as such in the ship's articles, and who shall be provided with surgical instruments, medical comforts and medicines proper and necessary for diseases and accidents incident to sea voyages, and for the proper medical treatment of such passengers during the voyage, and with such articles of food and nourishment as may be proper and necessary for preserving the health of infants and young children; and the services of such surgeon or medical practitioner shall be promptly given, in any case of sickness or disease, to any of the passengers, or to any infant or young child of any such passengers who may need his services. For a violation of either of the provisions of this section the master of the vessel shall be liable to a penalty not exceeding \$250."

There is a strong probability that the rat was responsible for the introduction of the plague into Oporto; there is little doubt that it was introduced into Santos through the same medium; private advices from Honolulu indicate that it was not there

introduced through food stuffs or merchandise, but that again the rat was the responsible agent.

Rats migrate from ship to ship along docks and quays in search of food, and ships loaded with rice and other food stuffs should therefore be particularly looked after. They should be subjected to fumigation prior to taking on cargo, and subsequently guarded to prevent as far as possible the invasion by rats.

That in the fleas of rats and mice we may find the bacillus of plague, was announced in 1897, giving plague to mice by inoculating them with infected fleas. That this bacillus may be inoculated into rats and mice by the bites of fleas is very possible, and it is proved that the fleas of rats and mice transmit the disease to man.

EFFECTS OF BATHS ON BLOOD PRESSURE.*

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Experiments to determine the effects on blood pressure of irritating ingredients added to baths of various temperatures and a comparison of these results with those obtained from a study of the separate effects of the various components of Nauheim baths, have given me definite results. The object of these experiments has been to simplify, if possible, the Nauheim bath or to find a substitute for it, and to ascertain what dangers there may be in using Nauheim baths in cases of high blood pressure from circulatory conditions.

All cardiac therapy, in acute and chronic disease, needs to be based upon a more rational physical basis, and drug therapy in particular is often disappointing to us because of the difficulty of measuring the working capacity of the heart and of influencing evenly and continuously the conditions under which it works. Cabot's experiments on the influence of drugs on blood pressure, during fever, showed plainly under what mistaken ideas we have carried on a good deal of our therapy in cases of severe heart tax.

For two years I have been working along the line of influencing the heart by lessening its work, and recording the clinical manifestations of improved heart action under these conditions. These manifestations are change in blood pressure, rate and evenness of pulse, amount of urine eliminated, and comparative comfort of the patient, especially where nervousness and insomnia are marked. It is, of course, difficult to judge all these conditions fairly, and the experimenter is often blind from over-enthusiasm. The observations, however, were many times made by nurses and the specially-trained attendants who have given baths for me, and the results are so uniform that it seems fair to state them as facts. I shall limit myself, in this paper, to the effects of baths on blood pressure.

The observations were in each case made by two

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persons. The machine used was a Stanton with wide cuff which was kept on during the baths. One person kept track of the patient's pulse while another made the readings on the mercury column. This was done to minimize the chance of error due to the natural desire to make the readings uniform. In all cases the readings were made three times and an average taken. The position of the mercury at the time of the reappearance of the pulse was taken as a measure of systolic pressure. The average morning pressure taken at 7 a. m. was determined to be about 15 mm. lower than the mean for the day. This pressure is raised promptly 15 to 20 mm. by the first meal and does not fall again until the usual drop in the late hours of night. The meals following the breakfast do not materially influence the pressure in patients who have had a hearty breakfast, but may raise it 10 to 15 mm. for a few hours in some patients.

The first case, exemplifying the above conditions, was a healthy male, aged thirty-seven years, with a slightly rapid heart, but no organic lesion. The following is the mean of the observations made at various times during two years: A fifteen-minute warm bath, 94° to 98° lowered the pressure on an average of 15 mm.; pulse rate varies little or nothing.

A fifteen-minute strong NaCl bath, seven pounds to forty gallons, 94° to 98°, lowered the pressure 10 to 15 mm.; the pulse may be slightly slowed.

A fifteen-minute calcium-chloride bath, one and one-half pounds to forty gallons, 94° temperature, raised the pressure 15 mm. This is true even if the pressure has been raised already by food taken a short interval before.

A fifteen-minute mustard bath, one and one-half pounds to forty gallons, 94°, had the same effect as a warm bath, lowering the pressure 15 mm., without altering the pulse. The skin was scarcely reddened.

Three pounds of mustard in a bath of 94° temperature, given for ten minutes, or the weaker mustard bath, with vigorous friction applied to the skin, has the effect of raising the pressure, and reddening the skin markedly for an hour or more. A fifteen-minute full strength, alkaline effervescent Nauheim bath, at 86° to 94°, raised the pressure rapidly during the first half of the bath, and more slowly during the last half, making it altogether about 20 mm. *This effect lasts during the daytime about four hours.* When the bath is taken at night, 11 p. m., the pressure on the following morning at 7 a. m. is not as low as normal by 5 to 10 mm., showing that the usual drop through the sleeping hours is not as marked as is normal.

In fevers, pneumonia, typhoid, septicemia, and abscess of lung after pneumonia, the blood pressure is always raised by the full strength Nauheim bath. This statement is based on more than 500 observations made in young and old, and includes cases complicated by the common forms of muscular and valve-heart lesions, and arterial changes. In no case was there a record of the pressure before the

acute illness, and during the illness there was no case whose pressure was above 160 mm. at any time. In pericardial effusion, paroxysmal tachycardia, and exophthalmic goitre, no improvement in pressure or pulse was observed.

The duration of the increased pressure in the calcium-chloride bath has not been studied.

When there is no increased pressure following a Nauheim bath, properly given, the muscular tone of the heart is dangerously weak, except in cases with very high pressure. In most cases where the pressure is not raised, the patient has been overtaxed physically in the effort of taking the bath, or the bath has not been strong enough or has been too warm.

In patients with high pressure from arteriosclerosis without kidney lesions, the results are very variable. As a rule the pressure changes but little from any kind of a bath. It is not uniformly raised by calcium chloride or the full strength Nauheim bath and may fall slightly for one-half to two hours after a bath. At the same time the pulse is slower, so that it would seem that the work of the heart had been much lessened for a time.

As blood pressure is dependent on the volume of blood in circulation, the peripheral resistance and the energy of the heart, it seems fair to look for improvement in circulation from anything that lessens the resistance or increases the heart energy. While regularity, slowing and fulness of the pulse follow the bath, there is no evidence that they result directly from the effects of the bath upon the heart in increasing its energy; they are dependent rather upon the lessening of the heart's work by lessening of resistance to be overcome. The lessened resistance alone, without a change in the heart's energy, would lower the pressure, so that the fact of a constant increase in pressure from Nauheim and calcium chloride baths is evidence of an increase in the heart's energy sufficient, not only to overcome the lowering caused by the peripheral dilation, but also to raise the pressure in the dilated peripheral vessels beyond what it was before. This is better understood when we realize that 299 parts of the heart's energy is expended normally in overcoming resistance, for every part expended in maintaining velocity. It is conceivable that the effects of lessened peripheral resistance is to conserve the heart's energy, thus giving more opportunity for maintaining velocity, and keeping up the pressure in the arteries.

CONCLUSIONS. Peripheral dilation from carbonated and calcium chloride baths show, by ordinary tests, that the heart's work is more effective.

In fevers the blood pressure is raised, which is not the case with ordinary heart stimulants (Cabot).

It seems likely that the calcium chloride bath is quite as effective as the carbonated bath.